

Virtual Sentry Framework Testbed

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So What? Who Cares?

- Space: SENTRY uniquely has common vision of a coherent “Virtual Sentry Framework” – not just an aggregation of individual research projects.
 - VSF Testbed provides infrastructure to demonstrate, evaluate, and collect data on an implementation of the VSF.
- Problem: Need to collect data (distributed sensing), fusion and analysis (distributed computing), and display within a decision support system.
 - Testbed must support entire SENTRY stack: sensors → analysis algorithms → behavioral modeling → design of the built environment both before and after the bang
- Solution: “VSF Testbed” distributed sensing and computing platform to develop evaluate technology integration within a decision support system.
- Results: First 5 months: Sensor network reference hardware nodes, communications, backend, and front end developed. RF situational nodes included, video aggregation and display. Mapping/digital twins. Beginning “Digital Dog Nose” integration.
- TRL: 6



What is the Virtual Sentry Framework Testbed?

VSF Testbed

Distributed Sensing and Computing Network:
Hardware (sensor nodes), backend/cloud fusion/analysis, front end command and control

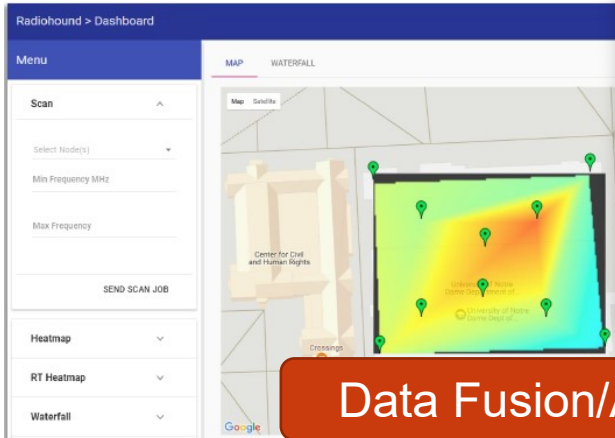
Decision Support:
Site survey, simulation/modeling, suggested interventions, data prioritization & presentation optimization



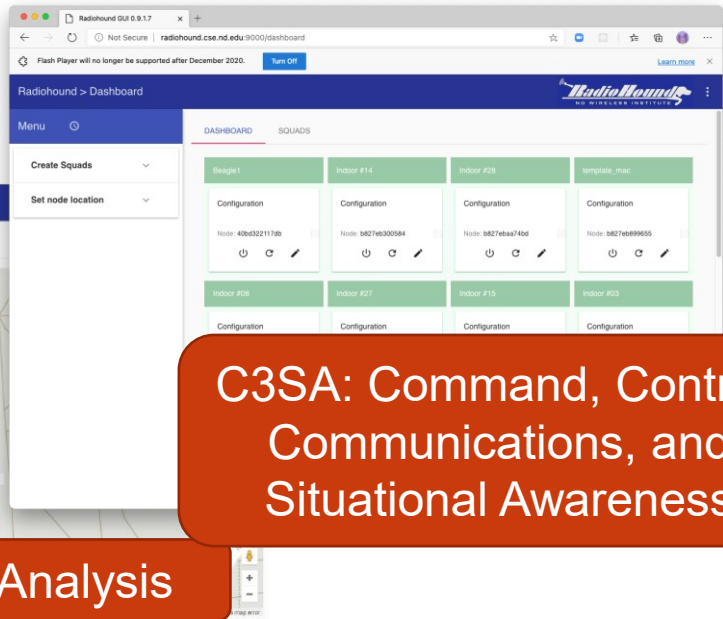
Distributed Sensing Network



Data Aggregation



Data Fusion/Analysis

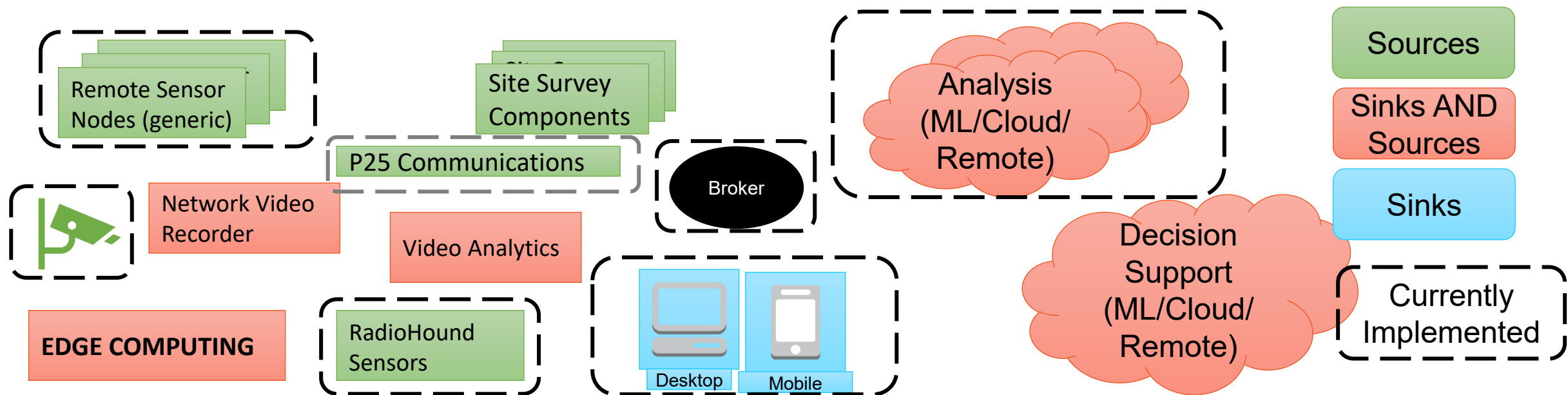


C3SA: Command, Control, Communications, and Situational Awareness



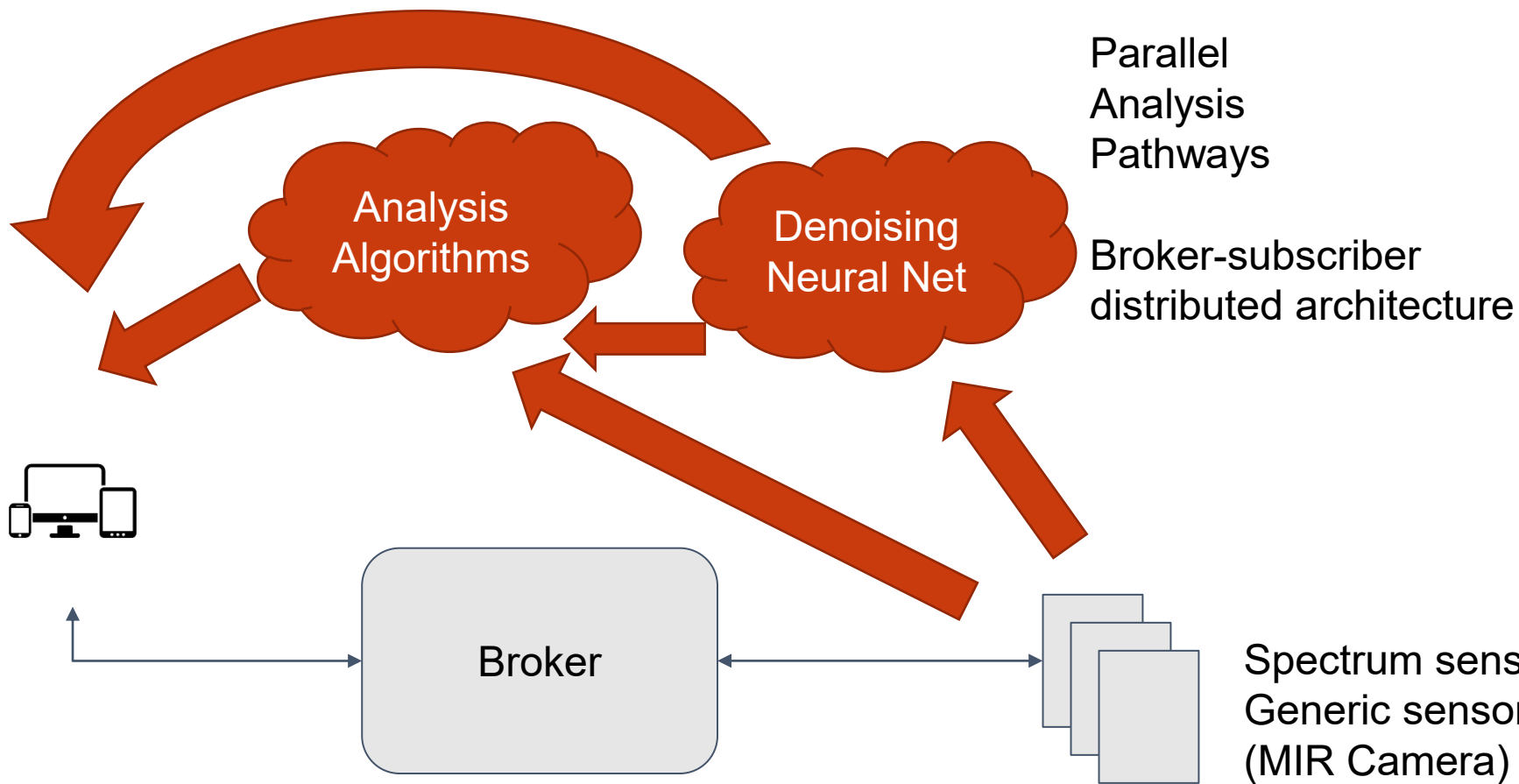
VSF Testbed Architecture (Abstraction)

- Key to the VSF Testbed: modularity and extensibility through well defined interfaces.
 - The VSF TB is just the “glue” that coordinates data sources and sinks.
 - IoT Broker-Subscriber Approach: Every sensor and algorithm is just a data source and/or data sink.
 - Example demo: IR video camera in South Bend, neural network denoising on ND’s campus, data aggregation w/ denoised video analysis in cloud, presented decision support in front end





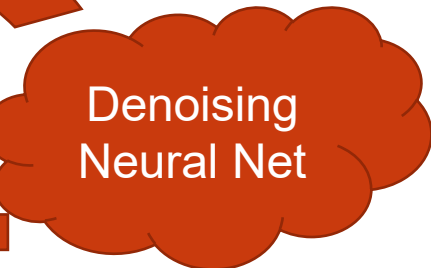
Example distributed sensing + computing



Spectrum sensing nodes
Generic sensor interface
(MIR Camera)

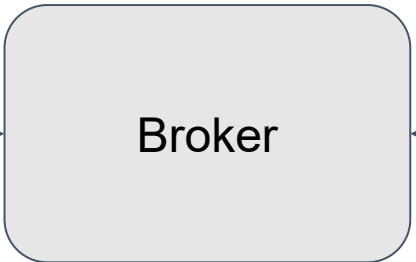
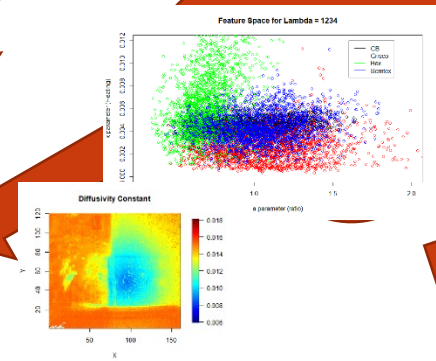


Example distributed sensing + computing

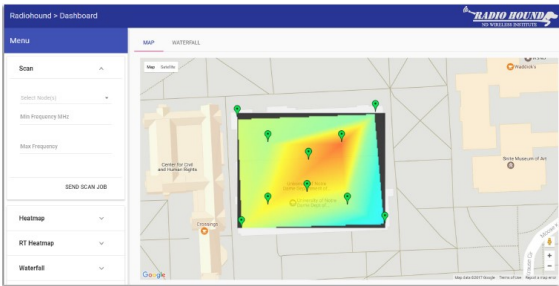
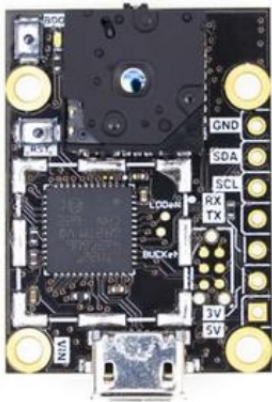


Parallel Analysis Pathways

Broker-subscriber distributed architecture

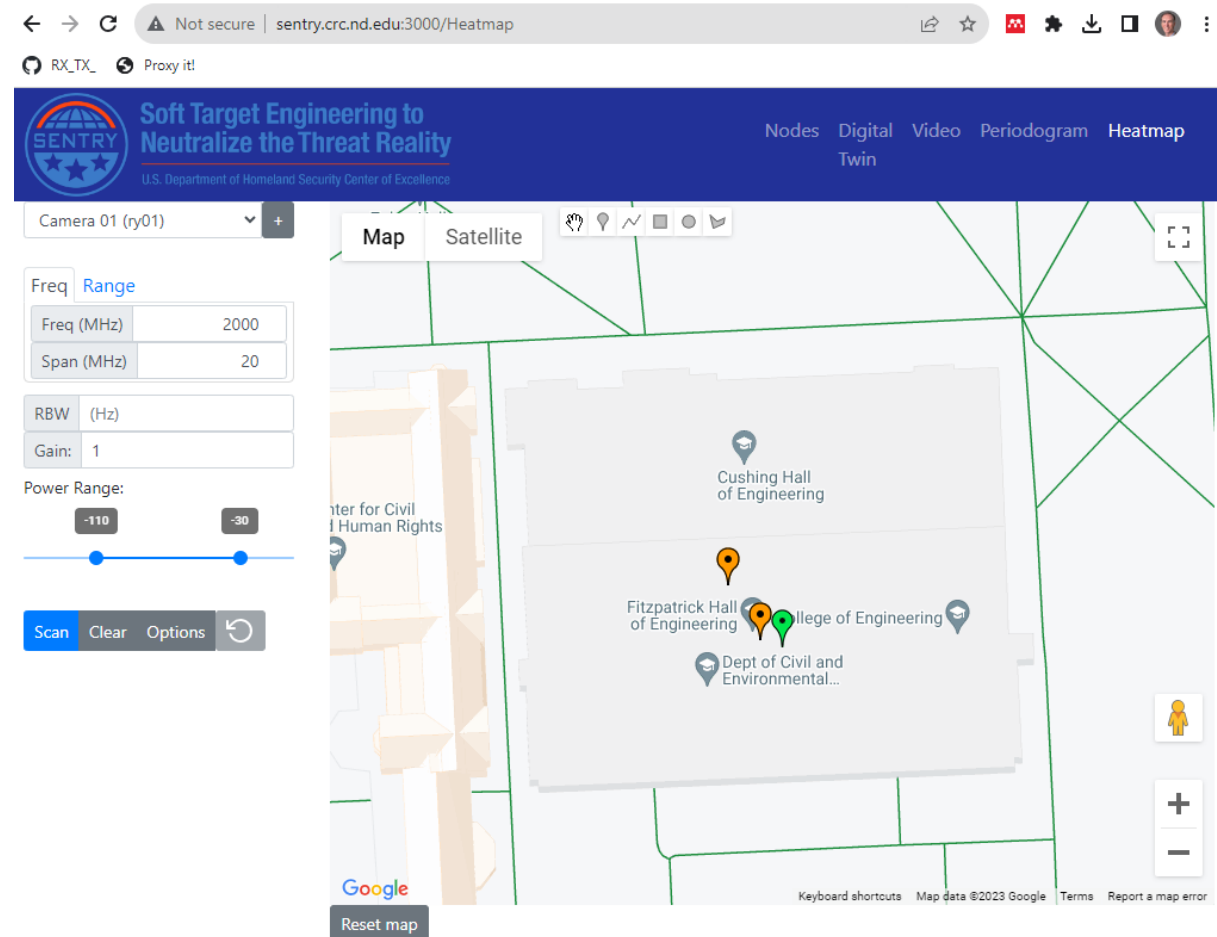


Spectrum sensing nodes
Generic sensor interface
(MIR Camera)



VSF Testbed Roadmap

- Short Term (1 year)
 - Establishing a permanent laboratory testbed demonstration
 - Integration of “Digital Dog Nose” (Otto Gregory, URI)
 - P25 Integration
- Medium Term
 - Establishing a permanent non-laboratory testbed
 - Additional sensors and algorithms (SENTRY and off-the-shelf)
 - SENTRY video analytics & digital twin integration
 - User authentication & specific data presentation
- Long Term
 - “Site Survey” decision support
 - Integration of SENTRY simulations (to support “site surveys”)
 - Additional non-laboratory testbed demonstrations
 - UI/UX: Looking for help with this!



Backup slides





Why Implement a VSF Testbed?

- SENTRY uniquely has common vision of a coherent “Virtual Sentry Framework” – not just an aggregation of individual research projects.
 - Individual research projects “live” on servers and sensor platforms all over the US.
 - Need: unified presentation of SENTRY projects’ decision support to stakeholders.
- Engineering and development of a testbed is outside of the scope of traditional academic research.
 - Leverage ONR funded ARL/Notre Dame “RadioHound” distributed sensor platform. Professional hardware and software engineers.
 - Project began 4 months ago: progress accelerated by existing platform and collaboration with NSF SpectrumX Center.